



**Forest
Practices
Board**

**Audit of Forest and Range Planning
and Practices Affecting Water Quality
in Oyama and Vernon Creek
Community Watersheds**

Okanagan-Shuswap District

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Board Commentary

Safe drinking water is a critically important resource to the people of British Columbia. In the Okanagan, much of the water used for domestic consumption comes from surface water supplies within community watersheds. At the same time, the land base in community watersheds is usually subject to a wide variety of uses, such as forestry, cattle grazing, mineral exploration and development, settlement and recreation, all of which have the potential to impact water quality.

To safeguard water quality and prevent health risks, government has taken a multi-barrier¹ approach, a key component being source water protection. The intent is to accommodate resource and recreational uses, but at the same time protect and minimize risk to water quality in all watersheds licensed for domestic water use, including community watersheds.

This audit, conducted in October 2010, is about the effects of forest and range practices on source water in two Okanagan community watersheds – Oyama Creek and Vernon Creek. The main potential effects of forest and range practices on water quality are the introduction of materials such as sediment or pathogens into the drinking water supply.

Audit findings identified low risk to water quality, quantity or timing of flow from current forest practices. Sediment was generally well-managed on forest road networks and harvesting practices protected nearby watercourses quite well. However the audit did find several significant non-compliances in the planning and practices of some range users, including cattle impacts on riparian areas and fish habitat, and a likely introduction of pathogens from some cattle feces into the source water of the community watersheds.

Auditors found that government range staff and range tenure holders are very aware of water quality issues and the need to address the risks associated with cattle grazing in community watersheds. In the last two years they have devoted considerable effort toward reducing cattle impacts on water quality. In particular, significant work has been done to improve range fencing with the goal of minimizing cattle impacts on some riparian areas and reducing direct deposition of feces into watercourses. The Ministry of Forests, Lands and Natural Resources Operations (MFLNRO – formerly the Ministry of Forests and Range) estimated that \$220 000 was spent on range improvements in the two watersheds within the two-year audit period. In addition, MFLNRO has developed best management practices for range use in community watersheds and is making progress in having these practices followed in these watersheds. At the time the audit fieldwork was conducted, these measures were underway.

Auditors also found a possible correlation between areas harvested prior to 1995 and areas where range practices impaired riparian function. Older cutblocks located adjacent to riparian areas seemed to have less coarse woody debris on the ground than cutblocks harvested after 1995, likely making it more difficult for range licensees to prevent cattle access to these areas.

¹ The principle aspects of government's multi-barrier approach to drinking water management include protecting source water, treating the water and maintaining and monitoring all parts of the water supply system's infrastructure.

The audit did not find a similar correlation between areas harvested subsequent to 1995 and riparian areas impaired by range activities.

Under the *Forest and Range Practices Act* (FRPA), agreement (licence and tenure) holders must comply with all elements of the range use plans (RUPs) that they submit to government, as well as legislated practice requirements. The Board found that RUPs for the audited watersheds included mandatory plus additional requirements, such as monitoring, that some agreement holders did not always adhere to. The Board believes ensuring full compliance with RUPs and practice requirements would go a long way to alleviate the issues identified in the audit watersheds. It acknowledges, however, that activities outside the control of range users can make this challenging.

Another thing auditors discovered was that agreement holders did not always have the information necessary for identifying and protecting specific values subject to practice requirements, such as fish habitat. The audit found range practices failed to protect fish habitat; moreover, agreement holders did not utilize available information about the distribution of fish and fish habitat within the range tenure. Using this type of information would have helped agreement holders meet this practice requirement. However, while much of this information is available through government, it may not be well understood or readily accessible by all tenure holders.

In terms of risk to water quality, the most vulnerable parts of both audited watersheds were the portions between the main storage lakes and the water supply intakes. In the report, these are referred to as 'unbuffered' parts of the watersheds. If cattle did not have direct access to streams and associated riparian areas in these zones, the human health risk associated with cattle would be significantly reduced. On the other hand, even if cattle were excluded from the watersheds, the raw water quality at the intakes probably would not meet Guidelines for Canadian Drinking Water Quality and the water purveyor would still need to make improvements to its existing treatment infrastructure to meet requirements imposed under the *Drinking Water Protection Act*. This is because of the other inputs of bacteria and parasites into the water supply as a result of human and wildlife use of the watersheds. The audit addressed compliance and effectiveness of practice requirements, but did not determine the extent of the incremental risk to drinking water associated with cattle use of the watershed.

In accordance with section 131(2) of the *Forest and Range Practices Act*, the Board is making the following recommendations:

1. In the audited watersheds, the risk of harmful substances reaching the water supply intake is much higher downstream of the two storage lakes. However, because of the varying risk in watersheds throughout the province, it can be difficult for practitioners to determine the probability that the harmful material will reach the intake.

Government should provide guidance on the implementation of the practice requirement to not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks, recognizing the variable risks within and between watersheds, of the harmful material reaching the intake.

2. Streams, wetlands and other areas with riparian function require protection from cattle impacts. Government should ensure that all watercourses and areas with riparian function are protected to the extent that range use does not materially impair their function.

The Board requests that the government advise the Board of its progress in addressing these recommendations by December 31, 2012.

The general public is well aware of the importance of clean, safe, drinking water. All users of the source watershed, including forest and range licensees, other tenure holders and recreationalists etc. have a role to play in protecting source water.

The Board recognizes the efforts of MFLNRO and forest and range licensees towards protecting water quality in the Oyama and Vernon Creek Community Watersheds, including significant investments made by MFLNRO in range fencing and off-stream watering.

Subsequent to the audit, MFLNRO has described its action plan to address audit findings, including:

- Implementing best management practices and range infrastructure improvements.
- Improving herd health in community watersheds.
- Improving monitoring through establishment of key areas.
- Improving coordination of forest and range activities in community watersheds.
- Proposed improvements to provincial guidance on range practices.
- Continued collaboration with community watershed stakeholders.

The Board believes that these and potentially additional measures are required to minimize the ongoing risks to water quality posed by range and other uses.

Executive Summary

Safe drinking water is a critically important resource to the people of British Columbia. This audit set out to assess forest and range practices in relation to water quality and fish habitat in two Okanagan community watersheds – Vernon and Oyama Creek. To do this, auditors assessed compliance of forest and range practices with applicable legislated requirements, and the effectiveness of practices in protecting these values, from September 2008 through October 2010.

The main potential effects of forest and range practices on water quality are the introduction of materials such as sediment or pathogens into the raw water supply. Also, the amount of timber harvested over time can affect the amount and timing of release of water in the watershed, which in turn can affect water quality.

The main potential effect of forest and range practices on fish habitat is direct disturbance to it or introduction of sediment—from logging, road construction or cattle activity.

The audit's key findings in relation to forestry practices

Compliance with legislative requirements

Audited forest practices were found to be compliant with legislative requirements in all significant respects

Effectiveness of forest practices

Overall, forest practices were found to be effective in protecting water quality and fish habitat

In particular:

- The audit showed that auditee plans and strategies effectively addressed potential water quality and quantity impacts.
- The audit showed that auditee forest practices were effective in minimizing impacts to water quality by effectively controlling sediment delivery into watercourses.
- In spite of the large amount of harvesting during the audit period, the audit showed no evidence that water quantity and timing of flow was or would likely be significantly impacted, given the buffering capabilities of the main lakes in each watershed.
- The audit also showed no evidence that forest practices have materially affected water quality at the intakes.

Key findings in relation to range practices

Compliance with legislative requirements

The audit showed range practices to be significantly non-compliant in relation to three requirements:

- Riparian function was damaged in several areas as a result of range practices.
- Range practices failed to avoid damage to fish and fish habitat in several areas.
- Harmful substances from cattle feces were introduced into the source water used to supply drinking water.

Effectiveness of range practices

Overall, range planning had deficiencies in addressing potential impacts from range use on water quality and fish habitat. In particular, stubble heights for riparian species were not utilized. Also, range planning did not adequately consider the need to protect fish habitat.

The audit showed that range practices within both watersheds were not fully effective in minimizing impacts to water quality. In particular:

- some range developments did not adequately protect riparian, fish and water values;
- some aspects of range use plans were not followed;
- riparian areas were not adequately protected;
- fish habitat was harmed; and
- substances harmful to human health were likely deposited into watercourses.

Auditors were not able to conclude whether or not range practices have materially affected water quality at the intake. However, range practices likely introduced *Campylobacter* and *Cryptosporidium* into the source water during the audit period. *Campylobacter* and certain species of *Cryptosporidium* represent significant health risks where present in concentration in drinking water.

Auditors noted the efforts made by MFLNRO to address water quality concerns during the audit period. New and replacement range developments were being established but had not yet been completed. However, some problems with the new developments were identified, and auditors were not able to predict the efficacy of developments to be completed after the audit fieldwork.

Overall, the audit showed that range practices need continued improvement to meet legislative requirements and further reduce risks to water quality.

Introduction

As a part of its 2010 audit program, the Forest Practices Board (the Board) selected the Okanagan-Shuswap District, located in the Thompson Okanagan Forest Region, for an audit of forest and range practices legislation.

Water is one of the 11 resource subjects referenced in FRPA legislation.

The district was selected randomly and not on the basis of location or level of performance. Within the district, the Oyama and Vernon Creek watersheds were selected for audit because they are community watersheds that provide water to a significant population; they have had a source water assessment completed for them under the *Drinking Water Protection Act* (DWPA); they have experienced significant levels of harvesting; and they have had fully allocated range tenures operating in them over the last two years.

The audit examined forest and range practices relevant to water quality, conducted between September 1, 2008, and October 25, 2010, for compliance with the *Forest and Range Practices Act* (FRPA) and the *Wildfire Act* (WA) and looked at whether the practices met the Board's water quality effectiveness criteria.

Section 122(1)(b) of FRPA mandates the Board to carry out periodic independent audits to determine compliance with requirements of forest and range practices legislation.

Audit Area

The Okanagan Shuswap District (see map on page 6) covers a relatively large area and includes the municipalities of Penticton, Kelowna, Vernon and Salmon Arm. In 2006, the population in the district was about 356 000.

There are about 57 community watersheds in the district, covering more than 360 000 hectares. The audit area included both the Oyama and Vernon Creek community watersheds, which supply most (about 60 percent on average) of the District of Lake Country's drinking water. The District of Lake Country (DLC) was incorporated in 1995 and includes the communities of Winfield and Oyama located between Kelowna and Vernon along the Highway 97 corridor. In 2009, the population of the DLC was about 11 400.

The two watersheds have intakes that collect water from the main creek. The upper portions contain lakes of various sizes, most of which have dams to control flow. The watersheds are characterized by snow accumulation in winter, with peak runoff from snowmelt occurring from April through June. Water not diverted to the distribution system supports downstream fish habitat.

The Oyama Creek community watershed is about 4220 hectares in size and its major lake is Oyama Lake. The north fork of Oyama Creek contains a series of small lakes and usually dries up in late summer. The Vernon Creek community watershed is about 8570 hectares. Swalwell (Beaver) Lake is its main lake and there are several smaller lakes upstream from it as well.

Both watersheds experience a wide variety of uses and activities. Commercial and recreational properties, mainly Crown leases, surround the larger lakes. There are designated recreation

sites as well as several areas used casually as camp sites. Both watersheds are used extensively for summer and winter activities including fishing, hunting, camping, boating, horseback riding, cross country skiing, and ATV and snowmobile use.

Regulation of water quality in the watershed

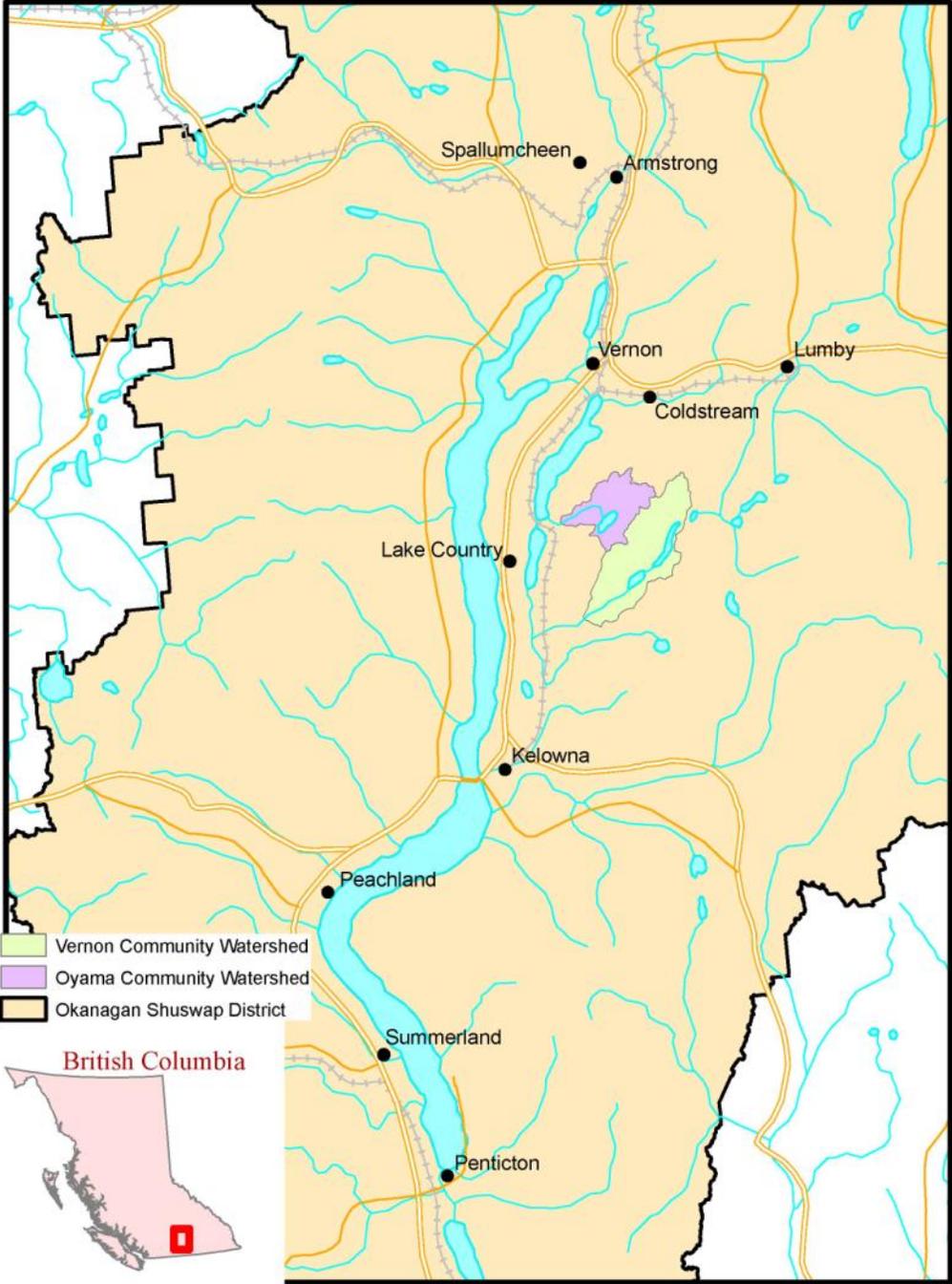
The watersheds are the primary source of water for the communities of Oyama and Winfield. The DLC is the water purveyor and has responsibility for supplying potable water to the communities in accordance with the *Drinking Water Protection Act* (DWPA) and regulation, which are administered by Interior Health, one of BC's regional health authorities. The DWPA does not regulate land use, but sets out the requirements for water quality protection that apply to water supply systems, whether on private or Crown land. Some requirements for water quality protection in the DWPA apply to all persons, including the prohibition of introducing anything into the water system that might contaminate a drinking water source.

The DWPA also authorizes health authorities to require water purveyors to prepare a source water assessment that describes land uses in the watershed; a description of the water supply system; a monitoring plan; and, evaluation of threats to the drinking water system. The DLC completed a source watershed assessment for the Oyama and Vernon Creek watersheds in 2010.

Crown land activities that might affect water quality are regulated by a number of statutes, depending on the type of activity. For example, although there are no active mines in the audit watersheds, the effect on the watershed, should mining occur, would be regulated under the *Mines Act*. Similarly, the effect of forestry, range and specific recreation sites and trails on the watershed are regulated under the *Forest and Range Practices Act* (FRPA), whereas management and control of forest fires and how that affects the watershed are regulated under the *Wildfire Act* (WA).

Fishing lodges are located on the largest lakes in the watersheds including Oyama Lake, Beaver Lake and Dee Lake. Numerous private land parcels and Crown lease lots are also located around these lakes. Development on the properties, including sewage management, is regulated by the Crown for lease lots, and local government for private land.

Map of Oyama and Vernon Creek Community Watersheds



Audit Scope and Approach

Audit Scope

The audit examined compliance with legislated requirements for forest and range practices that can affect water, and whether planning and practices met the Board's water quality effectiveness criteria.

Compliance with Legislated Requirements

Planning, harvesting, road, fuel management and range practices that can affect water, undertaken between September 1, 2008, and October 25, 2010, were assessed for compliance with FRPA, WA, and related regulations as well as certain transitional elements of the *Forest Practices Code of British Columbia Act*² (the Code).

Key FRPA water-related compliance requirements include:

For forest practices:

- must meet any results or strategies specified for water in forest stewardship plans (FSPs)
- must not deposit harmful substances, such as petroleum products, into streams, wetlands or lakes
- must not cause a debris torrent or landslide into a stream
- must conserve water quality and fish habitat in riparian areas
- must maintain natural drainage patterns for roads and revegetate disturbed roadside areas within two years if sediment might otherwise enter the stream system
- must notify water users before conducting road work
- in community watersheds, must
 - prevent material adverse impacts to water quantity or timing of flow
 - prevent water from having a harmful effect on human health which cannot be addressed through water treatment

For range practices:

- must conduct practices in accordance with water-related aspects of range use plans
- must prevent material adverse impacts to riparian areas
- must avoid damage to fish, fish habitat and fish passage
- in licenced watersheds, must
 - prevent material harmful to human health to be deposited into water diverted for human consumption
 - prevent damage to the waterworks and vegetation immediately surrounding it

For both forest and range practices:

- must not carry out practices that result in damage to the environment

² Although nearly all harvesting during the audit period was under FRPA, the silviculture prescription for one of Tolko's blocks was prepared under the Code. Under the legislation, the transition rules of the Code are applicable in harvesting this block.

The Board's audit reference manual, *Compliance Audit Reference Manual*, Version 6.0, May 2003, and the addendum to the manual for the 2010 audit season, set out the standards used to carry out the compliance portion of this audit.

Effectiveness of Practices

The key water-related effectiveness criteria used in this audit were:

For forest practices:

- Criterion 1: forest plans and strategies address potential water quality and quantity impacts
- Criterion 2: forest practices are effective in minimizing impacts to water quality, quantity and timing of flow
- Criterion 3: forest practices have not materially affected water quality at the intake

For range practices:

- Criterion 4: range plans and strategies address potential water quality impacts
- Criterion 5: range practices are effective in minimizing impacts to water quality
- Criterion 6: range practices have not materially affected water quality at the intake

Auditee performance in relation to these criteria was assessed primarily through interviews and examination of field practices.

Auditees

The primary focus of this audit is on forest and range practices and their effect on water, in the subject watersheds. Therefore, the principal auditees are the forest and range agreement holders who operated, or had ongoing responsibilities, in the watersheds between September 1, 2008, and October 25, 2010 (see Figure 2 – map of forest and range operations).

Forest Auditees

The forest auditees are:

- Tolko Industries Ltd. (for planning, harvesting and road responsibilities)
- BC Timber Sales (BCTS) Okanagan-Columbia Timber Sales Office (for planning and road responsibilities)
- Ministry of Forests, Lands and Natural Resource Operations³ (MFLNRO) (for small scale salvage harvesting)

Within the audit area, nearly all harvesting and road construction during the two-year audit period was to address mountain pine beetle. The infestation level in the watersheds has been increasing over the last several years and salvage is the main strategy for this area. Beetle infestations are light to moderate in both watersheds.

³ District operations, including the district's small scale salvage operations and the range program, were formerly conducted within the former Ministry of Forests and Range (now MFLNRO).

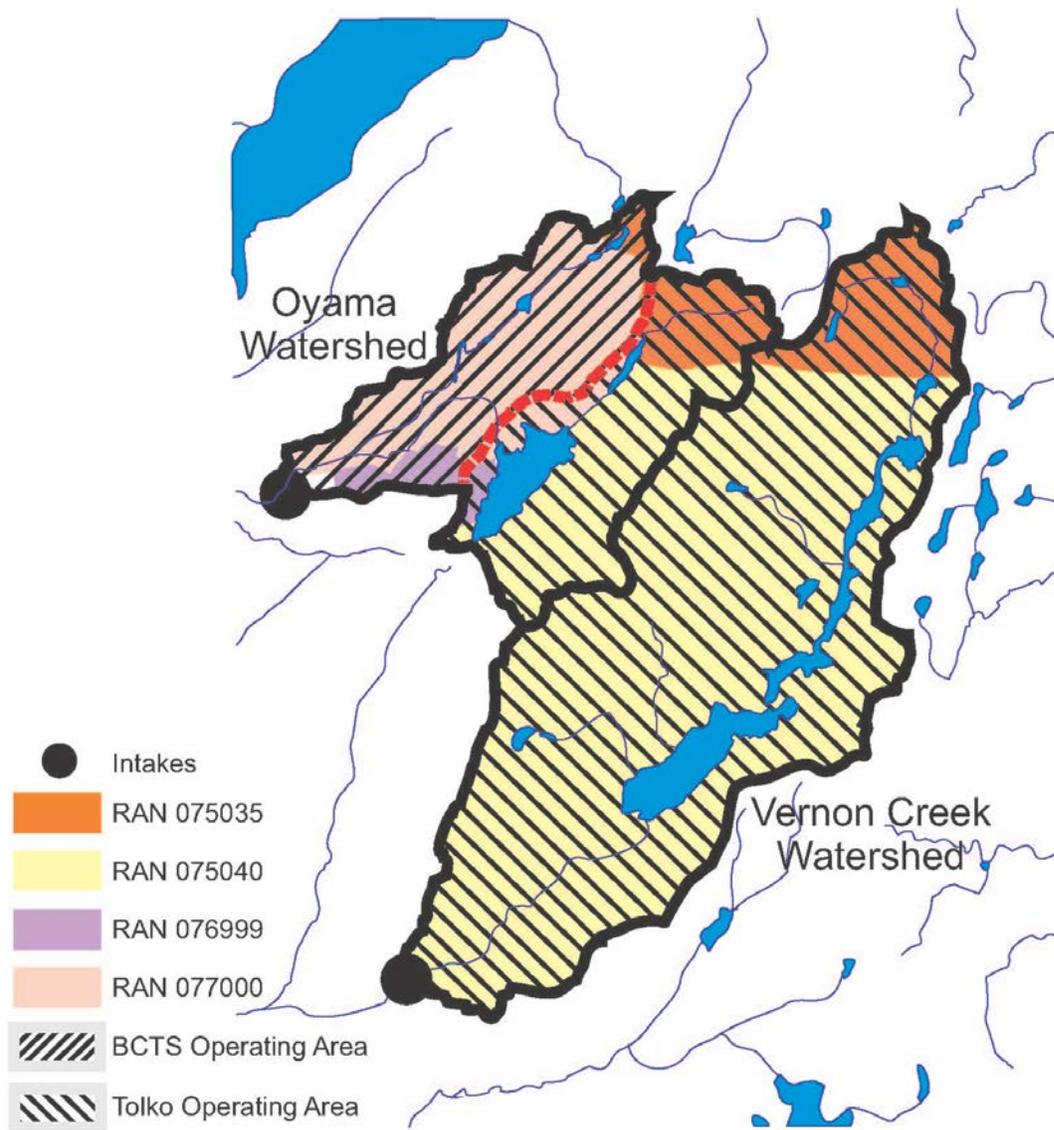


Figure 2 – Map of forest and range operations in the Oyama and Vernon watersheds.

Tolko’s operating area covers the majority of the audit area, including the Vernon Creek watershed and the southeast portion of the Oyama Creek watershed. During the audit period, Tolko harvested 30 cutblocks totaling 1164 hectares and built about 54 kilometres of new road, mostly within those cutblocks. Tolko had ongoing road maintenance responsibilities for road permit and forest service roads (FSRs) within their operating area, except for non-status or private roads or roads managed by the Ministry of Transportation and Infrastructure (MOTI).

BC Timber Sales (BCTS) has an operating area in the northwest part of the Oyama Creek watershed. They have not identified much high priority beetle timber in this area at present, so no harvesting or road building was done by the program’s licensees during the audit period. Similar to Tolko, BCTS has ongoing responsibilities for the roads within its operating area, except for non-status or private roads or those managed by MOTI.

In addition, nine forestry licences to cut were harvested under MFLNRO's small scale salvage program, totaling about 60 hectares. These harvest areas were mostly clearcut, with a few partial cuts, and are scattered through the two watersheds. All of these operations were designed to salvage small volumes (less than 2000 cubic metres) of beetle killed timber and none included road construction.

Beaver Lake Road, the main access road into the Vernon Creek watershed, is maintained by MOTI. Although all roads on Crown land were considered for assessment in this audit, this ministry's road activities are not conducted under FRPA and therefore were not subject to the audit.

Range Auditees

Figure 2 shows the range agreement boundaries in relation to the two audit watersheds. Portions of four grazing licences are within the audit area:

- RAN 075035 – Coldstream Ranch Ltd.
- RAN 075040 – Eldorado Ranch Ltd. and Coldstream Ranch Ltd.
- RAN 076999⁴
- RAN 077000

Audit Approach

In undertaking this audit, the audit team carried out the following main steps (the Findings and Conclusions sections of this report describe the findings from this work). Each of these audit steps assessed aspects of both compliance and effectiveness. The methods used in these audit steps are described in more detail in Appendix A – Audit Methodology.

Audit fieldwork was undertaken from October 18 to 25, 2010.

Interviews

Auditors interviewed the following key organizations and individuals involved in managing water in the audit area:

- All auditees
- MFLNRO range staff in Vernon
- Interior Health Authority drinking water officers from Kelowna and Salmon Arm
- Ministry of Environment (MOE) water quality specialist
- District of Lake Country (DLC) water utility staff

Estimating sediment from roads, trails and landslides

The audit used a methodology developed by the government Forest and Range Evaluation Program (FREP) to estimate the quantity of sediment generated and delivered to natural drainages from selected sites associated with forest and recreation activities (refer to the FREP website⁵ for its water quality effectiveness evaluation protocols).

⁴ Individuals, not corporations, hold RAN 076999 and RAN 077000. It is Board practice to avoid using individuals' names in its reports. Therefore only the licence number is provided.

⁵ <http://www.for.gov.bc.ca/hfp/frep/index.htm>

Estimating sediment delivery to natural watercourses,⁶ lakes and wetlands relies on knowledge of the variety of sediment inputs, whether natural or otherwise, within the watershed. Accordingly, the audit examined sediment from numerous sources, including permitted industrial roads, trails, non-status roads, roads maintained by MOTI, and natural sources such as landslides.

The audit did not examine forest practices or range practices associated with crossings in locations where there was no direct connectivity to watercourses and therefore no risk of sediment reaching a watercourse, wetland or lake, or of cattle use impacting water quality.

Assessing cattle effects at road crossings

Cattle use roads and trails to access forage and water. Cattle often obtain water from within the clearing width of roads, including roadside ditches and where roads cross watercourses, because access is easy and usually not impeded by vegetation and woody debris, which often occurs in a natural wooded area. Extended use of watercourse crossings by cattle can damage channel banks and fish habitat; disturb soil, resulting in increased sediment; and increase risk of fecal contamination.

Using the FREP methodology, auditors evaluated a total of 15 range indicators where there was evidence of cattle disturbance at the road or trail crossings of watercourses. Auditors also examined cattle disturbance of fish habitat at road crossings on assumed or confirmed fish streams (discussed later in this section).

Assessing cattle effects on riparian function

Auditors assessed the compliance and effectiveness of range practices in relation to riparian function, by completing a riparian health assessment, a variant of a widely adopted method referred to as a proper functioning condition (PFC) assessment.⁷ The Board has conducted riparian health assessments in previous work.⁸

The audit examined riparian health in riparian areas as defined by the *Range Planning and Practices Regulation* (RPPR)⁹ and in unclassified riparian areas. In this audit, the term ‘riparian area’ is used when site conditions meet the definition of riparian area in the RPPR. The audit

⁶ In this audit, ‘watercourse’ refers to a broad range of natural drainages including streams and non-classified drainages (NCD). Streams are defined by the *Forest Planning and Practices Regulation* or the *Range Planning and Practices Regulation*. A non-classified drainage is a watercourse that does not meet the definition of a stream as defined by the RPPR or FPPR. A roadside ditch is not considered a natural watercourse.

⁷ There are numerous methodologies for assessing proper functioning condition. FLNRO uses two—one developed by branch range staff and one by FREP. This audit used a similar but simpler methodology than these two. It is likely that PFC assessment results for individual stream sections would vary slightly, depending on the methodology utilized, but overall results would be quite similar.

⁸ Effect of Cattle Grazing near Streams, Lakes and Wetlands: A results-based assessment of range practices under the Forest Practices Code in maintaining riparian values. Forest Practices Board Special Report. (http://www.fpb.gov.bc.ca/SR11_Effects_of_Cattle_Grazing_near_Streams_Lakes_and_Wetlands.pdf)

⁹ Under the Range Planning and Practices Regulation (RPPR), the term ‘riparian area’ has a specific meaning. It is an area of land that:

- (a) is adjacent to a stream, lake or wetland, and
- (b) contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas;

The regulation also gives specific meaning to a ‘stream’ and a ‘wetland’.

uses the term 'unclassified riparian areas' to describe areas that provide riparian function but do not meet the definition of riparian area.

For example, since under the definition a riparian area occurs *adjacent* to a stream, lake or wetland, the area within the wetland is not part of the riparian area. Therefore, this audit refers to the area within the wetland as an 'unclassified riparian area.' Similarly, the area adjacent to an NCD (which does not meet the definition of a stream) is also referred to as an 'unclassified riparian area.'

The audit did not examine range practices in upland locations where there was no direct connectivity to watercourses, wetlands or lakes and therefore a low risk of sediment or harmful materials from feces reaching these areas. However, within each transect of a riparian area or unclassified riparian area, the audit considered other possible sources of impacts to riparian health including roads, ATV trails and forest harvesting.



Figure 3 – Example of an 'unclassified riparian area' in the Oyama Creek watershed that does not meet the definition of riparian area because the area assessed is not adjacent to, but rather within, the wetland.

Assessing cattle effects on fish habitat

Auditors evaluated cattle impacts to fish and fish habitat within riparian health assessment transects and at various sites such as road crossings.

Fish habitat quality assessments were undertaken when fish presence was either known or assumed and fish habitat appeared to be impacted by cattle or other land uses such as ATV trails, roads, etc.

Assessing cattle fecal material

Auditors collected fecal material (referred to as fecal pats) deposited by cattle within and adjacent to a watercourse or wetland and adjacent to a lake.

The samples were tested for the bacteria *E. coli* 0157:H7 and *Campylobacter*, and the protozoa *Giardia* and *Cryptosporidium*.¹⁰ These bacteria and protozoa are considered harmful to human health.

¹⁰ *Cryptosporidium parvum* is harmful to human health and found in cattle feces, most often in feces of young calves. *Cryptosporidium andersoni* is also found in cattle feces and may not be harmful to human health. Because of the prohibitive cost of sample species identification, the audit assessed whether *Cryptosporidium* was present in the samples but did not identify the exact species of *Cryptosporidium*. Therefore, in this audit there is a degree of uncertainty whether a positive sample of *Cryptosporidium* is harmful to human health.

Findings and Conclusions

– Forest Planning and Practices

Compliance

The audit examined documents and field practices to assess compliance with water-related FRPA obligations in the two community watersheds for the period September 1, 2008, to October 25, 2010.

The audit found that planning, harvesting and road operations undertaken by Tolko, BCTS and MFLNRO's small scale salvage program (SSSP) complied in all significant respects with the FRPA's water-related requirements.

Effectiveness

Criterion 1: Forest plans and strategies address potential water quality and quantity impacts

During the audit period, Tolko conducted most of the forestry activity. BCTS did not do any harvesting and the district's SSSP requires site level plans but not FSPs. Consequently, most of the discussion under Criterion 1 is about Tolko's planning.

Operational Planning

Tolko completed hydrologic watershed assessments for both watersheds in 2008, consistent with its FSP strategy for community watersheds. The assessments were focused particularly on the equivalent clearcut area (ECA)¹¹ level at that time and the projected ECA level assuming all pine in stands with greater than 40 percent pine were killed by mountain pine beetle.

Using this information, Tolko developed retention plans for both watersheds. The plans called for expeditious reforestation after salvage harvesting of beetle-attacked, pine-leading stands. In comparison to simply leaving the pine stands alone, in 30 years this approach would reduce the projected ECA above the intakes from 48 percent to about 21 percent for Oyama Creek, and from 45 percent to about 21 percent for Vernon Creek. However, in either scenario, the peak flow hazard is high, with a likely impact on water quality.

Tolko's harvesting during the audit period reflects the implementation of its retention plan, and its watershed assessments and retention plans demonstrate consideration of the likely hydrological impacts of forest cover reductions as a result of the mountain pine beetle infestation. According to the assessments, whether the susceptible pine is harvested or left to die from attack, there will be increased peak flows with resulting impacts on water quality.

Although there is uncertainty about how much pine would be killed if left untreated, the planning Tolko has undertaken does consider potential impacts to water quality and quantity over time. The audit found this type of planning to be valuable in dealing with this risk.

¹¹ Refer to the following web link for a definition of ECA
(<http://www.for.gov.bc.ca/hfd/library/documents/glossary/Glossary.pdf>)

During the audit period, Tolko harvested more than 1100 hectares of timber and BCTS did not harvest at all. Auditors noted this large difference in activity levels but did not closely examine the reasons. Tolko implemented its retention plan, which entailed harvesting a large amount of pine-leading timber. When these cutting permits were timber cruised in 2008 and 2009, the timber was heavily attacked by mountain pine beetle, with an average green attack level of 23 percent. In contrast, BCTS deferred harvest in its portion of the audit watersheds until beetle attack levels increase and harvesting becomes a higher priority.

Tolko's site plans for cutblocks harvested during the audit period were found to be effective in protecting riparian areas.

Certification

Both Tolko and BCTS operations in the Okanagan-Shuswap District are certified under the Canadian Standards Association's Sustainable Forest Management (CSA SFM) standard. Under this scheme, they prepared and follow a sustainable forest management plan (SFMP), developed in consultation with a local public advisory group. Annual monitoring reports are prepared each spring which indicate whether targets for each of the indicators have been met.

Of the indicators and targets related to various aspects of forest management contained in the SFMP, several relate to water and riparian resources:

- *Proportion of disturbed area in watersheds* – the target is to maintain the ECA so that the peak flow hazard is moderate or lower. This entails watershed assessments and reporting ECAs where harvesting occurs. As noted above, the implementation of Tolko's retention plan resulted in an ECA with a high peak flow hazard. In cases of high peak flow hazard, the licensee must ensure harvesting practices are consistent with recommendations made in watershed assessments.
- *Water quality impacts at watershed stream crossings* – to minimize sediment delivery at stream crossings, the target is to complete a water quality effectiveness evaluation (using the same methodology as used in this audit) of new or reconstructed permanent stream crossings and to have no crossings rated as "high" sediment sites. As no new or reconstructed permanent crossings were installed in the audit area by either Tolko or BCTS during the audit period, there were no instances where a water quality effectiveness evaluation was completed.
- *Road inspections* – the target is to complete inspections of permanent and temporary roads with a frequency commensurate with their risk rating – higher risk roads should be inspected more frequently. Inspections would identify maintenance problems requiring work as well as what temporary roads require rehabilitation to help conserve soil and protect water quality.
- *Revegetation* – the target is to revegetate permanent road cuts and fill slopes as soon as possible to minimize erosion and reduce the spread of noxious weeds. The audit found that on roads that were Tolko and BCTS's responsibility, no erosion problems were identified that showed lack of revegetation to be a significant contributor.
- *Protect riparian areas* – the target is to protect riparian areas so that no instances of damage occur. The licensee is to report any occurrences of damage. The audit found that

Tolko's harvesting practices conducted within the audit period were effective at protecting riparian areas. BCTS did no harvesting within the audit period.

With the exceptions of revegetating disturbed areas and protecting riparian areas, the water-related commitments made in the SFMP are voluntary and not specifically required under forest practices legislation. Tolko and BCTS reported their performance in meeting these targets over the whole district.

Conclusion for Criterion 1:

Overall, the audit found that auditee plans and strategies effectively addressed potential water quality and quantity impacts.

Criterion 2: Forest practices are effective in minimizing impacts to water quality, quantity and timing of flow

Forest Practices Observations

The focus of the field work was on those forest practices that could have impacts on water quality. Sample sites targeted mainline and branch roads accessing recent cutblocks and, to a lesser extent, in-block spur roads, non status roads, recreation sites and other disturbed areas, including natural slides.

At each sample site, auditors examined the effectiveness of practices at protecting water quality. Overall, they found that road construction, maintenance and harvesting practices were effective in minimizing impacts to water quality.

Licensee forest practices were effective in minimizing erosion and protecting watercourses, wetlands and lakes. In most locations, licensees:

- protected roads from structural failures using armouring and well-placed drainage features
- deactivated temporary roads
- revegetated exposed soils
- directed ditch water onto the forest floor and away from watercourses
- effectively identified riparian management areas as well as NCDs and retained non merchantable timber and understory vegetation in their vicinity
- piled slash away from riparian management areas to help protect water quality



Figure 4 – Metal water-bar used to intercept and disperse road sediment across a BCTS FSR in the Oyama Creek watershed.



Figure 5 - Armouring with large rocks around the bridge protects the structural integrity of the bridge footings, and can sometimes deter cattle from accessing water at the crossing.

Sediment Estimates

A total of 96 sites were assessed for sediment delivery potential in the two watersheds.

Where roads are located near watercourses, wetlands and lakes, it is not always possible to prevent sediment from entering these areas. Road construction, maintenance and deactivation practices all expose soil, as do some harvesting practices such as building and using excavated or bladed skid trails. Traffic on gravel road surfaces also generates fine sediment throughout the road's life. The amount of fine sediment

generated depends on the road surface materials, surface area, degree and type of use and gradient of alignment. Exposed soil is subject to erosion. The risk of erosion is highest where exposed soil particles are small (such as silt) and rain or snowmelt can transport the sediment downslope into ditches and streams.

The other main sediment source is landslides, either natural or associated with forest practices. The audit examined the watersheds for evidence of landslides in an aerial watershed assessment and during the audit work on the ground. Several historic natural landslides have occurred in lower slopes, mainly adjacent to Vernon Creek, and continue to introduce sediment into the watershed. However, no recent landslides were detected, either natural or associated with forest practices. Landslides tend to be the largest potential sediment sources within a watershed compared with other forms of erosion.

The assessment results are grouped into categories (Table 2) reflecting the volume of sediment (in cubic metres) expected to be delivered into the stream system over a year.



Figure 6 – Metal cross drain used to intercept sediment-laden road surface runoff and ditch water and direct it onto the forest floor away from the watercourse. Fencing and rip rap around the crossing exclude cattle from the watercourse.

Table 2 – Sediment estimate categories

Estimated Sediment generated at site (cubic metres)	Site Sediment Generation Classes	Significance
<1 m ³	Low Impact	Site may generate some sediment but within the range that would be considered normal for background levels of stream turbidity. Site likely reflects good management practices.
1-5 m ³	Moderate Impact	Site generating levels of sedimentation that would be measurable and, under special situations, of interest to watershed managers. Improvements could be considered.
5-20 m ³	High Impact	Site generating unacceptable levels of fine sediment and have a significant impact on water quality in a watershed. Remedial action warranted if result of forest practices.
>20 m ³	Very High Impact	Site generating very high levels of sediment with major consequences for water quality within a watershed. Remedial action warranted if result of forest practices.

Table 3 – Results of estimated sediment delivery over a one-year period

Responsible Party or associated factor	Low Sites (<1 m ³)		Moderate Sites (1-5 m ³)		High Sites (5.1-20 m ³)		Very High Sites (>20.1 m ³)	
	Oyama	Vernon	Oyama	Vernon	Oyama	Vernon	Oyama	Vernon
Auditee Sites								
BCTS	11	0	3	0	0	0	0	0
Tolko	10	10	4	5	0	0	0	0
SSSP	2	0	0	0	0	0	0	0
MFLNRO*	0	1	0	0	0	0	0	0
Non-auditee Sites								
MOTI**	0	4	0	13	0	0	0	0
Non-status roads***	7	7	0	2	0	0	0	0
Recreation sites or ATVs	9	2	0	1	0	0	0	0
Totals	39	24	7	21	0	0	0	0
Overall Totals	63 (69%)		28 (31%)		0 (0%)		0 (0%)	
Natural Sites								
Natural sites (slides)****	0	0	0	0	0	1	0	4

* Where a forest service road has not been assigned to a forest operator and the responsibility for maintenance remains with the MFLNRO district manager.

** MOTI is responsible for the Beaver Lake road into Vernon Creek watershed.

*** Not all non-status roads were assessed. For example, the lower portion of the Oyama Road was not examined due to access limitations.

**** Since these natural sites are not associated with forest practices they are excluded from the totals.

Table 3 shows the results obtained from the sediment estimates. For all sites that were the responsibility of auditees, sediment delivery was found to be low or moderate. The only high or very high sediment sites detected in the audit were those associated with natural slides in the Vernon Creek watershed. These results indicate that operators are controlling sediment delivery well.

The audit identified 13 moderate sediment delivery sites under MOTI jurisdiction on Beaver Lake Road. This road is the main access into Vernon Creek. Although MOTI is not subject to this audit, this road was assessed because it is within the watershed and sediment from this road network affects water quality. However, the audit found that this road was well maintained, with water well directed off the



Figure 7 – Natural slides adjacent to Vernon Creek.



Figure 8 – Beaver Lake Road.

running surface and culverts in appropriate locations. The road is about eight metres wide — almost double the width of most other roads in the watershed — and has a relatively high level of use. These factors lead to a larger amount of sediment yield compared with most forest roads.

Water Quantity and Timing of Flow

Tolko harvested 1164 hectares during the audit period. BCTS did not harvest, while the SSSP harvested approximately 60 hectares. The area harvested during the audit period was almost 10 percent of the total area of the two watersheds, so the harvesting increased the overall ECA in the watershed by about this amount. However, virtually all of this harvesting was done in upland areas, upstream of Oyama and Swalwell Lakes (one salvage area of 7 hectares was downstream of Swalwell Lake).

These lakes act as a buffer¹² for sediment and their outflows are regulated as part of the water supply system. Therefore, any peak flow increases that may have resulted from harvest levels during the audit period will be mitigated by the buffering of these lakes (figures 9 and 10 illustrate the buffered and unbuffered portions of the two watersheds). This buffering effect makes it extremely unlikely that forest practices during the audit period had a significant effect on water quantity and timing of flow.

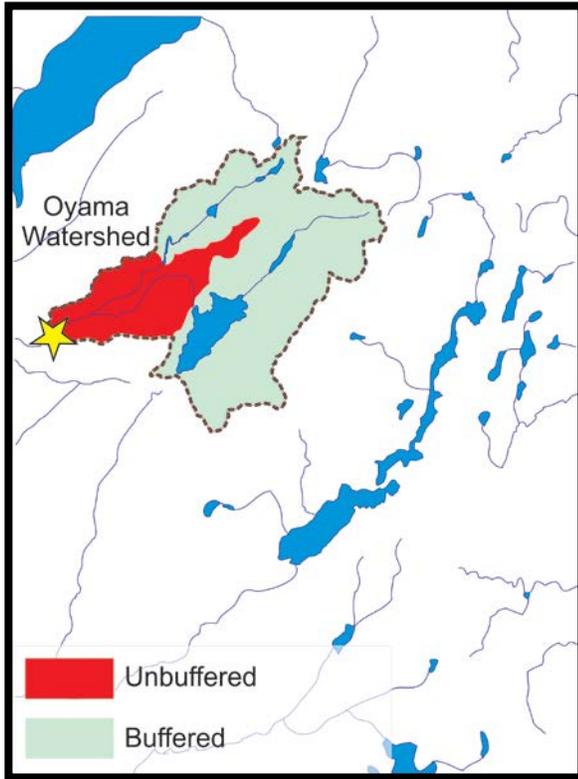


Figure 9 – Buffered and unbuffered areas of Oyama Creek watershed.

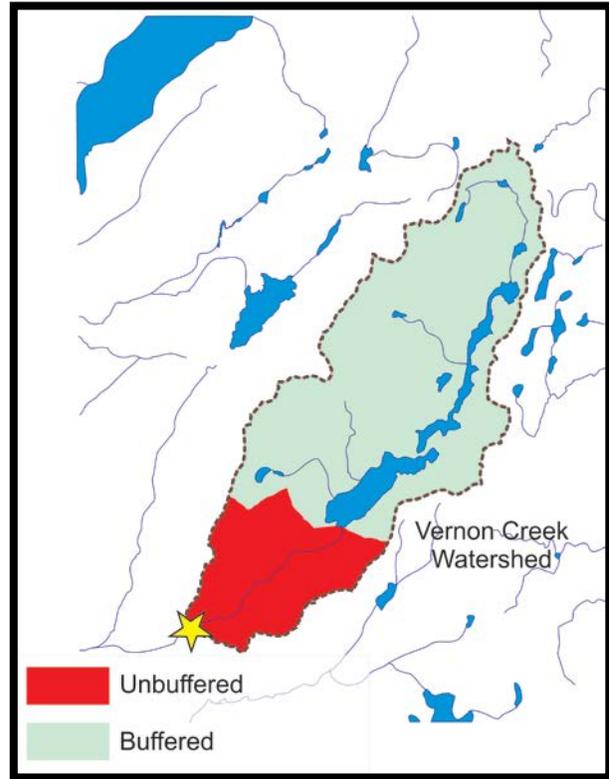


Figure 10 – Buffered and unbuffered areas of Vernon-Creek watershed.

Because most harvesting was in buffered areas within the two watersheds, the audit did not undertake a detailed examination of the ECA changes resulting from the harvesting during the audit period. The audit also did not examine potential future effects of accelerated harvesting on water quantity since that is outside the scope of the audit.

Conclusion for Criterion 2:

Auditors found that auditee forest practices were effective in minimizing impacts to water quality by effectively controlling sediment delivery into watercourses. In spite of the large amount of harvesting during the audit period, there was no evidence that water quantity and timing of flow was, or would likely be, significantly impacted.

¹² In this audit, the terms 'buffered' and 'unbuffered' refer specifically to the buffering capabilities of the main lakes in the two watersheds. The lakes act as a buffer because water spends time in the lake before moving through the lower, unbuffered part of the watershed and into the water supply intakes. The increased residence time of water in the lakes allows sediment to drop out of the water as well as retaining pathogens long enough for them to be rendered inactive. In addition, the lakes act as buffers to reduce the impact of increased peak flows in upstream areas. The lakes fill during the spring runoff and water is released slowly during the remainder of the year.

Criterion 3: Forest practices have not materially affected water quality at the intake

The water quality parameter most influenced by forest activities is turbidity, which is a measure of the relative clarity of water. More specifically, it is a measure in NTU¹³ of the scattering effect of light by particles suspended in water. In a forestry context, these particles are typically made up of clay and silt components of soil and organic matter, such as leaf fragments.

By itself, turbid water from suspended sediments is not a significant health risk. However, in addition to causing drinking water to taste and look unappetizing, turbidity interferes with water treatment because biological organisms such as algae, bacteria and viruses adhere to the surface of the particles. This reduces the success of water treatments, such as ultraviolet light and chlorination, in eliminating pathogens. Also, turbid water is more expensive to treat and can cause problems in water supply systems by clogging filters (refer to Appendix B for a discussion of the major factors that affect water quality).

The Guidelines for Canadian Drinking Water Quality (CDWG) recommend a turbidity of less than one NTU for treated drinking water and less than five NTUs for aesthetic objectives. For reference, drinking water with turbidity greater than five NTU would be noticeably cloudy in a glass.

Forest operators do not monitor water quality directly. DLC staff monitor certain parameters of raw water quality. Presence or absence of *E. coli* and other coliforms are monitored as well as some water chemistry and physical characteristics. Average 2009 monthly turbidity at the water intakes for the two watersheds is shown in Figure 11. The data for 2010 is quite similar.

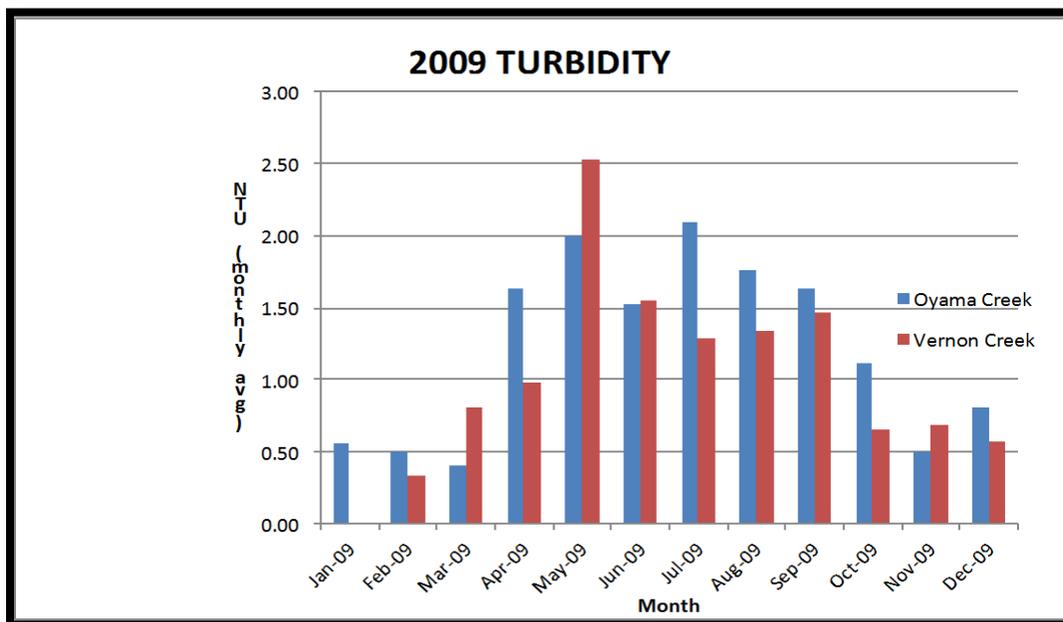


Figure 11 – 2009 average monthly turbidity levels for the watersheds.

¹³ NTU – nephelometric turbidity units – this is an indirect measure of the level of suspended matter (organic and inorganic) in water. It is a measure of the light reflected by particles suspended in water, which can vary depending on a particle’s shape, colour and reflectivity.

For 2009, the monthly untreated water turbidity levels at the intakes for the two watersheds were below the one NTU level recommended by the CDWG for about half of the year and below two NTU most of the time. As typical for interior watersheds, the highest turbidity levels are associated with spring runoff.

These averages mask peak turbidity events that may occur over a few minutes, hours or days as a result of upstream erosion and sedimentation. Maximum values occasionally exceeded 10 NTU and usually could be traced to specific sites upstream. In the cases reported on Vernon Creek, stream bank failures and small landslips were the primary source of fine sediment causing the turbidity spikes.

There is no way to determine turbidity levels that occurred prior to when forest practices first started in the watershed, as data was not collected at that time. It is therefore not possible to isolate the amount of turbidity inputs as a result of forest practices above baseline levels. However, the monthly average turbidity levels measured by the DLC during the audit period are reasonably low and the audit found that the estimated sediment delivery from forest practices is also reasonably low (69 percent low and no sites with high or very high estimated sediment yield). Given that the main effect of forest practices on water quality is sediment delivery, the audit findings suggest that forest activities have not significantly affected water quality at the intakes.

Conclusion for Criterion 3:

The audit found no evidence that forest practices have materially affected water quality at the intakes.

Findings and Conclusions

– Range Planning and Practices

Compliance

In its assessment of compliance, the audit found three instances of significant non-compliance with FRPA requirements for range practices, relating to riparian function, water quality and fish habitat. The audit found that range practices:

- did not adequately protect riparian areas in the Oyama Creek watershed;
- were not conducted in a manner unlikely to harm fish and fish habitat in both watersheds; and
- did not prevent substances harmful to human health from entering the source water supply in both watersheds.

To avoid duplication, the audit evidence and discussion for both compliance and effectiveness are included in the effectiveness section of the report.

Responsibility for Non-Compliances

During the audit period, numerous observations were made of cattle movement between tenures; cattle being out of sequence in the pasture rotation; and cattle remaining on the tenure beyond the period of use specified in the agreement holder's range use plan. The auditors made some observations during their audit fieldwork and tenure holders recorded some observations prior to the audit fieldwork. In some cases, particularly within the Oyama Creek watershed, cattle from adjacent tenures were observed in riparian areas that had been assessed.

The movement of cattle between tenures raises a level of uncertainty about which agreement holder, or holders, bears responsibility for the range practice that led to the non-compliance.

For this reason, the audit was not able to determine which range agreement holder was responsible for an individual non-compliance.

Further, the impacts to riparian health and fish habitat discussed in the next several sections occurred during the audit period and likely for several years prior to that.

Effectiveness

Criterion 4: Range plans and strategies address potential water quality impacts

Range Planning

In the summer of 2009, routine water samples collected by DLC staff at the Oyama Creek community watershed intake identified high levels of *Escherichia coli* (*E. coli*) bacteria. The DLC investigated and observed high levels of cattle use within and adjacent to accessible points on Oyama Creek and several tributaries. The DLC suspected that cattle in the watershed could be a source of the contamination.

In September 2009, the DLC complained to the Interior Health Authority (IHA) requesting that cattle be removed from places where they could interfere with the community's water supply.

The IHA considered the request and in September 2009 asked MFLNRO to develop and implement a plan that would mitigate risks to drinking water from range cattle accessing source waters supplying the Vernon Creek and Oyama Creek drinking water intakes.

MFLNRO responded to IHA's request and submitted watershed range plans to the IHA on April 30, 2010. The plans identify historical range issues in the watersheds; areas vulnerable to disturbance by cattle; range developments required to better manage cattle distribution and avoid sensitive areas; best management practices for range use; and a monitoring strategy. The watershed range plans were used to direct the content of the agreement holders' new RUPs for implementation in the 2010 grazing season.

Best Management Practices

MFLNRO has developed and implemented a set of best management practices (BMPs) for range activities in community watersheds.¹⁴ Some examples include:

- Limit time and timing of use so that cattle will not spend excessive time and use too much riparian vegetation.
- Where necessary, prevent livestock access to streams and lakes. Provide buffers by strategic fence and barrier placement near outlets.
- Create distinct riparian pastures that allow controlled timing and access to riparian features.
- Limit livestock watering to hardened access points (nose holes) that prevent direct access to a stream wetland or lake.
- Provide off-stream water using gravity feed systems, nose pumps or sling pumps.
- Do not turn calves under four months of age on Crown range within community watersheds (young calves are often *Cryptosporidium* carriers).
- Remove or dispose of the carcasses of dead animals from riparian zones.

The district has included aspects of these BMPs into RUPs. In addition, range developments have been planned and implemented in consideration of these BMPs. The BMPs demonstrate the district's awareness of concerns over water quality and constitute a positive effort to address those concerns.

Content of range use plans

Each of the four range agreement holders in the Oyama and Vernon Creek watersheds has a RUP, signed by both the agreement holder and the district manager. The new RUPs took effect prior to the 2010 grazing season and have more detailed content related to the protection of riparian zones and water quality (the former RUPs expired at the end of the 2009 grazing season).

The new RUPs include content required by legislation as well as actions to address issues identified by the district manager. Many of the issues identified by the district manager, and actions to address those issues, were incorporated from the watershed range plans developed by MFLNRO and reviewed by IHA. They include:

¹⁴ "Best Management Practices on Crown Range in Community Watersheds" (June 2011)
<http://www.for.gov.bc.ca/hra/Practices/index.htm>

- The identification of vulnerability zones on RUP maps.
- Minimizing cattle congregating within a 30-metre band on each side of the high water mark of main stem creeks, or five metres from the top of the bank (whichever is greater) between reservoir and intake.
- Minimizing cattle concentrating within riparian areas above one kilometre upstream from intakes.
- Minimizing the introduction of *Cryptosporidium* from young calves.
- Incorporating actions regarding the watershed range plans including communication and monitoring.
- Identifying actions to minimize impacts and maintain healthy riparian areas, in general, with specific reference to sites of concern in the watershed.

These prescribed actions appear reasonable in that they address water quality and riparian function.

The RUPs specify stubble heights for bluebunch wheatgrass and pinegrass. However, with the exception of the RUP for Coldstream Ranch Ltd., there are no stubble heights identified for riparian species. The absence of prescribed stubble heights for riparian species in three of the four RUPs means that there are no easily measured limits of safe use in sensitive riparian habitat. The ministry can require the RUP holder to include appropriate elements, such as range readiness criteria and stubble heights, to meet government's objectives, but did not do so. In the instances where the ministry did not require the inclusion of stubble heights for riparian species (three of four RUPs) auditors found the RUPs to be deficient and planning not to be effective.

They also found that the RUPs did not address fish or fish habitat, nor were they required to under legislation. Without considering the locations of fish habitat, and prescribing actions to avoid harming fish habitat, there is a consequent gap in planning that may have contributed to the impacts to fish habitat identified in the audit.

The RUPs include logical and comprehensive requirements for monitoring at the start of the 2010 grazing season. Monitoring is focused within high-risk vulnerability zones and includes the establishment of key areas with monitoring indicators, including stubble heights, channel impacts (channel and bank degradation) and prolonged congregation of cattle. The RUP commits agreement holders to following the monitoring, reporting and communications components of the watershed range plans and completing 'rancher monitoring forms' in key areas on a weekly basis or more frequently as required. The monitoring component of the watershed range plan sets out monitoring priorities for MFLNRO and range agreement holders and commits MFLNRO to completing monitoring at least once every 14 days throughout the grazing season.

Conclusion for Criterion 4:

The audit found that, while range plans meet legislative content requirements and address potential water quality impacts, they fall short of being effective because:

- Three of four RUPs do not include stubble heights or other easily measured limits of safe use for riparian species even though much of the focus of the RUPs is around protection of riparian zones and water quality.

- There are gaps in range planning, such as identifying and addressing the location and prescribed actions to protect fish habitat. This information could assist range practitioners in meeting practice requirements.

Criterion 5: Range practices on forest land within watersheds are effective in minimizing impacts to water quality

Range Developments

Over the past two years, MFLNRO, with provincial and federal funding partners, invested in range developments in both watersheds, and work is on-going. Within the audit period, MFLNRO estimates that nearly \$220 000 was spent in the two watersheds on new fence construction, replacement of fence that was no longer functional and cattle watering facilities (nose holes and water troughs). At the time of the audit, range developments had been partially implemented and more infrastructure work was planned subsequent to the audit.



Figure 12 - fencing effectively excludes cattle from the riparian area at this crossing.

In the unbuffered portion of the Oyama Creek watershed, many of the access points on larger streams were fenced. However, cattle were still heavily using the remaining smaller and unfenced watercourses. As a result, the audit observed significant cattle impacts to the



Figure 13 – “nosehole” on North Fork of Oyama Creek.

watercourses and associated riparian habitat. For example, the audit team assessed riparian health on 2074 metres adjacent to smaller, unfenced, non classified drainages and found that 76 percent, or 1586 metres, was in a non-functioning condition.

Because most of the range developments were new when the audit fieldwork occurred, it was not possible to ascertain their efficacy compared to before the improvements were installed. The audit also acknowledges that additional range development work that was to be completed



Figure 14 – water trough in Oyama Creek located away from stream and riparian area.

- Auditors observed three off-channel, gravity-fed cattle watering troughs in the Oyama Creek watershed. In general, off-channel watering can be quite effective at reducing cattle impacts on streamside areas. Two of the three water troughs were located in close proximity (around 30 metres) to Oyama Creek and overflow runoff from the trough was directed towards the creek. When congregating around watering troughs, cattle deposit fecal matter, which may be



Figure 15 – fence crossing North Fork of Oyama Creek.

after the audit may help address issues detected in the audit.

The audit did, however, identify a few areas where range developments resulted in potential water quality impacts or harm to riparian function. These included:

- A nose hole (cattle watering facility) that was reconstructed on Oyama Creek during the audit period (see figure 13). The nose hole was effective in confining cattle access to this part of the stream. Cobbles placed around the nose hole also helped minimize streambank damage and sedimentation. However, the nose hole site also had fecal material located within the high water mark, which is a potential source of pathogens into the unbuffered part of the watershed. One fecal pat sampled at the nose hole tested positive for *Cryptosporidium*.

transported to the creek by surface runoff (e.g., excess water from trough being returned to creek) rainfall and snowmelt.

- Several sites were identified where new range fence has been constructed across watercourses and wetlands. As cattle tend to move along fence lines, the result has been concentrated use and impacts to watercourses and wetlands at the fence line locations.
- In the Oyama Creek watershed, clearing of the right-of-way for construction of a replacement range fence caused significant impacts to a seasonal watercourse over a distance of approximately 100 metres. While this practice is not an effective way of protecting riparian values, the consequences for water quality may be minimal as the watercourse did not flow directly into a stream or lake.

Range Development Approval

The efforts in planning for, repairing and improving range infrastructure demonstrate a keen awareness of the importance of protecting water quality. However, issues with the location, type and installation of some range developments as identified above raises questions about how range developments are planned and approved.

Section 51(4) of FRPA requires that the minister only approve a range development if it is consistent with a RUP, any objectives set by government¹⁵ and will adequately provide for the range resources of the area. In addition, section 39 of the RPPR includes two restrictions on government's approval of range developments. First, the minister may not grant an authorization for a range development if it is to be constructed within 50 metres of a stream in a community watershed, unless satisfied that the construction and use of the range development is consistent with the objectives set by government for water and water quality objectives. Second, the minister may not approve the range development if it would alter vegetation, soil or terrain in a manner that would be similar to contravening a range practice requirement, unless no other practicable option were available and the area restored after construction.

The range use plans applicable to the watershed include an issue identified by the district manager to "minimize cattle congregating within a 30-metre band on each side of main stem creeks". In the Oyama Creek watershed, there are numerous instances within the high risk, unbuffered portion of the watershed where replacement range fence is located less than 5 metres adjacent to Oyama Creek and sometimes less than one metre. Also, the audit found 3 instances (1 nose hole and 2 gravity fed water troughs) where cattle watering facilities are located on or within about 30 metres of Oyama Creek.

As part of approving range developments within the Oyama and Vernon Creek watersheds, the audit did not establish how the district manager considered the requirements of section 51(4) of the FRPA and section 39 of the RPPR or the content of the RUP. The district manager did not document how the approved range developments would be consistent with the RUP, government's objectives for water or whether the range development would alter vegetation, soil or terrain in a manner similar to a contravention of the range practice requirements.

¹⁵ Note: Within the audit period, government had not declared specific 'water quality objectives' for either the Oyama or Vernon Creek community watersheds, pursuant to S 8(2) of the *Government Actions Regulation*.

Cattle movement

During the audit fieldwork, which took place October 18 to 25, 2010, numerous cattle were detected in the Oyama Creek watershed, even though the RUPs require all cattle to be off these ranges by October 15. The range use plans require that:

- 100 percent of the herd to be removed at the end of the grazing season by the scheduled date. Stragglers are to be actively pursued on a daily basis and gathered and removed within a 24-hour period once located.

Two of the auditees stated that typically cattle move off the ranges towards their winter locations once the weather turns cold, thereby reducing efforts required to round up cattle across the tenure. However, by relying on cold weather to round up cattle, an extended period of warm weather beyond the date specified in the grazing schedule could result in cattle being on the tenure longer than the term approved in the RUP. This approach for removing cattle from the range at the end of the grazing season is not effective in terms of preventing overgrazing, protecting riparian areas and features, and water quality.

In addition to cattle remaining on the tenure beyond the period of use specified in the grazing schedule, auditors noted instances of cattle 'drift' between tenures and between pastures within a single tenure. This became problematic when assigning responsibility for range practices. While it may be difficult to fully prevent drift between tenures, more diligent monitoring and control of the location of the herd by agreement holders could reduce the extent of drift. Auditors were told that planned range fencing would help alleviate the cattle drift problems once completed.

Range monitoring

A commitment to range monitoring for the Oyama and Vernon Creek watersheds is a major component of the watershed range plans. In turn, RUPs commit to the monitoring outlined in the watershed range plans. Range monitoring commitments include the following elements:

- Key areas to be established by MFLNRO in unfenced, high-risk vulnerability zones prior to the start of the 2010 grazing season.
- Range agreement holders monitor stubble heights of indicator species, and channel and bank degradation in key areas on a weekly basis.

In addition, agreement holders commit to completing the following monitoring protocol:

- Monitoring for range readiness for turnout, stubble heights and utilization of browse;
- Following through on actions to address issues identified by the district manager;
- Inspecting and repairing range developments prior to and during use of pastures;
- Reporting of activities to MFLNRO range program during (in the event of change to grazing schedule) and after the grazing period by December 31 annually. This will include cattle movement within and between pastures, salting practices and other activities that occur during the grazing season.

- The following monitoring will be conducted by range program staff (anticipated frequency of once every 14 days):
 - Ensure that range practices comply with the requirements of the RUP, such as indicators of stubble heights (key areas identified on RUP map), browse use and adherence to grazing schedule;
 - Forest and range evaluation inspections for community watersheds to provide basic information to assess risk, and potential risk, to water quality (This evaluation will be conducted on “key areas” within the community watershed);
 - Range health evaluation, including riparian and upland assessments of health and function (these evaluations will occur within key areas or entire creek systems or lakeshores).

The monitoring strategy included in the RUPs and the watershed range plans is comprehensive. Monitoring forms are well thought out and sufficiently detailed to provide the necessary information to apply effective range management. However, the audit found that the monitoring strategy had not been fully implemented because:

- MFLNRO had not yet established all key areas in the watersheds. At the time of the audit, three key areas had been established: two in the north fork of Oyama Creek and one in Vernon Creek below the lake. The establishment of key areas is a crucial component of the monitoring strategy. Because this was not completed, the monitoring program could not be fully implemented.
- Range tenure holders conducted monitoring, though to varying degrees. One of the range agreement holders completed some monitoring at key areas, one kept an informal diary of cattle use and movement and a third agreement holder did not document any monitoring. Typical reasons provided for not utilizing the monitoring forms were their complexity and the length of time required to complete them. MFLNRO made improvements to the data collection requirements late in the audit period. This may assist tenure holders in documenting their monitoring activities.
- MFLNRO range staff did not meet their commitment to monitor the watersheds once every 14 days. Although staff conducted some range monitoring, riparian health assessments were not done on key areas. Range staff indicated that, in retrospect, they did not have sufficient resources to meet their ambitious monitoring commitments in the watershed range plans.

Overall the audit found that a strong monitoring framework was established in the watershed range plans and RUPs. However, range staff and tenure holders did not fully meet the monitoring commitments.

Riparian Areas

Cattle effects on riparian areas

The RPPR requires that range practices not have a material impact on the ability of riparian areas to function properly. Section 30¹⁶ of the RPPR requires that range practices not have a material adverse effect on the ability of the riparian area to:



Figure 16 – impacted stream bank in North Oyama Creek.

- a) withstand normal peak flow events without accelerated soil loss, channel movement or bank movement,
- b) filter runoff
- c) store and safely release water and
- d) conserve wildlife habitat values in the area.

In this audit, where these abilities are seriously compromised, as determined through a field riparian health assessment, the riparian area is evaluated as “not functional.” Where a riparian area is ‘not functional’ as a result of range practices, it is considered to be a non-compliance with s. 30 of the RPPR because the practices have had a material adverse effect on the riparian area in achieving these four functions. Where a riparian area is “functional at risk” there has been some impairment in its ability, as a result of range practices, to achieve one or more of these four functions (‘functional at

risk’ areas are not considered to be a non-compliance with s. 30).

As previously discussed, not all riparian transects met the definition of riparian area as defined by regulation.

¹⁶ S. 30 RPPR – Riparian areas

A range agreement holder must not carry out a range practice if it would result in a material adverse affect on the ability of the riparian area to

- (a) withstand normal peak flow events without accelerated soil loss, channel movement or bank movement,
- (b) filter runoff,
- (c) store and safely release water, and
- (d) conserve wildlife habitat values in the area.

To illustrate, 32 transects, covering a distance of 5367 metres, were completed in the Oyama Creek watershed. Sixty-one percent (3293 metres) of the total length assessed was in riparian areas while the remainder was in areas the audit refers to as ‘unclassified riparian areas’ (see the following section for results for unclassified riparian areas).

The results of the riparian health assessment for the Oyama Creek watershed (see Table 4) show that 16 percent of the length of riparian areas assessed, totaling 517 metres of stream or wetland, were in a “not functional” condition and therefore not compliant with the requirement of s. 30 of the RPPR to protect riparian areas.

In the Vernon Creek watershed, 6 percent of the length of riparian area assessed, totaling 262 metres of stream or wetland, as not functional and, therefore, not compliant with the requirement of section 30 of the RPPR to protect riparian areas (Table 4).

Table 4: Results of riparian health assessments for ‘riparian area’ transects.

Watershed	Total length of transects (metres)	Results of riparian health assessment		
		Properly functioning (metres)	Functional at risk (metres)	Not functional (metres)
Oyama	3293	2430	346	517
Vernon	4070	3326	482	262
Total	7363	5756	828	779

The audit found that, in several instances in the Oyama Creek watershed, range practices failed to adequately protect riparian areas contrary to the legislation. This is a pervasive non-compliance and is therefore considered significant.

The audit found fewer instances in the Vernon Creek watershed where range practices failed to protect riparian areas. Because the non-compliances were not pervasive in the Vernon Creek watershed they are not considered significant.

Cattle effects on ‘unclassified riparian areas’

Unlike riparian areas, the RPPR provides no specific protection for riparian and other aquatic habitats that do not meet the definition of riparian area. Therefore, in this audit, the assessment of cattle impacts on these unclassified riparian areas cannot legally be considered under s. 30 of the RPPR. Nonetheless, in an operational sense, care should be taken in these areas as well to minimize impacts from cattle use.

The audit findings reveal significant differences between the Oyama and Vernon Creek watersheds in the amount of unclassified riparian areas. In the Vernon Creek watershed, no assessments were completed in unclassified riparian areas.¹⁷

¹⁷ There may be several factors influencing the type of watercourses in the watersheds including soils, moisture regime and terrain. In the Oyama watershed, many of the larger streams in the unbuffered portion of the watershed have been fenced or are inaccessible to cattle because of steep terrain. This could be causing cattle to exert more pressure on smaller unfenced watercourses in the watershed.

The results of the riparian health assessments for unclassified riparian areas in the Oyama Creek watershed reveal that 76 percent of the length of unclassified riparian areas assessed, totaling 1586 metres of watercourse or wetland, were in a not functional condition (see Table 5 and Figure 18).

Table 5: Results of riparian health assessments for 'unclassified riparian area' transects.

Watershed	Total length of transects (metres)	Results of riparian health assessment		
		Properly functioning (PFC) (metres)	Functional at risk (FR) (metres)	Not functional (NF) (metres)
Oyama	2074	403	85	1586
Vernon	0	0	0	0
Total	2074	403	85	1586

In two areas, totaling approximately 800 metres of watercourse, the extent of cattle impacts to the watercourse meant that auditors could not clearly establish if the watercourse met the definition of a stream under the RPPR. As a result, the length of watercourse was treated as an unclassified riparian area and not a riparian area.

The audit found numerous instances in the Oyama Creek watershed where range practices failed to adequately protect unclassified riparian areas. The amount of unclassified riparian areas found impacted in the audit is pervasive. Although compliant, this range practice is not considered to be effective.

In the Vernon Creek watershed, range agreement holders were generally effective in protecting riparian areas and unclassified riparian areas.

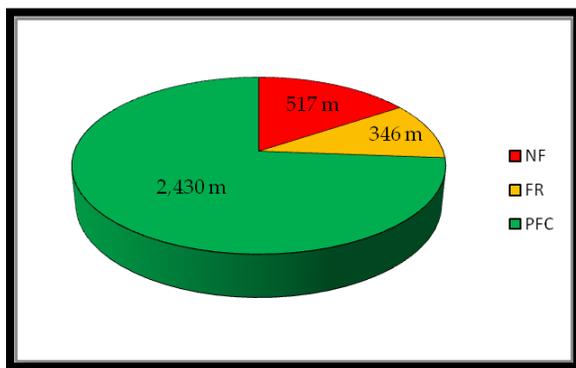


Figure 17: Oyama Creek watershed - length (m) of riparian area transect by riparian health assessment result.

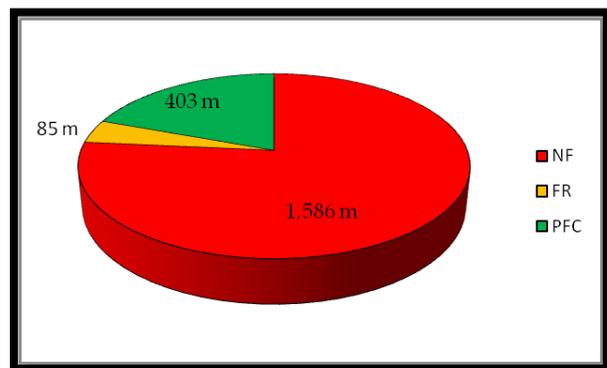


Figure 18: Oyama Creek watershed - length (m) of 'unclassified riparian area' transect by riparian health assessment result.

Cattle effects at road crossings

A total of 96 sites were assessed for sediment delivery potential in the 2 watersheds (an equivalent number of sites were completed in each watershed). Of the 96 sites, a total of 56 sites were assessed for potential range impacts to water quality using FREP assessment methodology

(refer to Appendix A for explanation of methodology). Of the 56 sites, 32 sites were ranked as having a high level of cattle impact to the natural drainage. A further 16 sites had a moderate level of impact and the remaining sites either had low or no impacts to the natural drainage. Typical problems caused by cattle include pugging or trampling of the soil, destruction of stream side vegetation and introduction of silts and fecal matter to the watercourse. Observations of cattle impacts at stream and watercourse crossings for both the Oyama and Vernon Creek watersheds are summarized in Table 6.

Table 6 - Summary of observed cattle impacts to natural drainages by watershed.

Watershed	Number of observations and level of cattle impact to riparian function at road crossings of natural drainages		
	*High	*Moderate	Low or None
Oyama - buffered	9	6	2
Oyama - unbuffered	1	6	2
Vernon – buffered	17	1	1
Vernon - unbuffered	5	3	3
Total for audit area	32	16	8

** Refer to Appendix A – Audit Methodology for an explanation of these ratings.*

The audit evidence suggests that range practices around stream crossings are not effective in protecting water quality. Although auditors encountered comparatively fewer high and moderate impact sites in the unbuffered portions of the two watersheds, the level of cattle impacts (high and moderate combined) suggests that more effective practices are required to isolate these easily accessed areas or employ more effective practices to move cattle frequenting these areas.¹⁸

Harvesting and cattle access to riparian areas

During the field audit, auditors observed an apparent correlation between older harvesting activity and improved cattle access to riparian areas and features, resulting in increased use and impacts to riparian habitat. Observations made in the field warranted subsequent analysis of the issue.

Forest inventory polygons were compared with riparian area and unclassified riparian area transects to identify locations in the vicinity of harvest cutblocks. This information was supplemented with observations made during the audit. Although the analysis has limitations in terms of other factors that may increase or impede cattle access to riparian habitat (e.g. proximity to roads, coarse woody debris retained on site, retention and width of streamside

¹⁸ In December 2011 FREP published Extension Note #22 – Summary of Provincial Water Quality Effectiveness Evaluation Results (2008-2010). This report showed similar results. In 2009, 38 percent of range assessments upstream of water intakes tested positive for potential water quality impacts and in 2010, 71 percent tested positive for potential water quality impacts. The report stated that “potential water quality impacts most frequently occurred due to free range cattle having access to streams via resource roads (lack of control structures) and riparian areas (lack of riparian retention).”

http://www.for.gov.bc.ca/hfp/frep/publications/extension_notes.htm

buffers, etc.), it is sufficient to provide qualitative information on possible relationships between harvest activity and cattle access to riparian habitat.

The results indicated a correlation between pre-Code harvesting activity (prior to 1995) and increased cattle access to riparian areas and unclassified riparian areas (no transects were associated with post-Code harvesting activity). For example, for riparian areas in both watersheds combined, there was almost no harvest activity in the vicinity of transects that were assessed in the audit as properly functioning. In contrast, the majority (about three-quarters) of transects assessed as not properly functioning were associated with pre-1995 harvesting activity.

The relationship between forest harvesting and increased cattle access to riparian habitat is well known by range agrologists in MFLNRO. During the audit, auditors observed that harvesting activity (all conducted prior to 1995) often resulted in removal of vegetation and coarse woody debris both adjacent to and across streams and watercourses. The removal of the coarse woody debris may have been a key factor in enabling cattle access to riparian habitat.

In contrast, auditors observed current harvesting practices where machine free zones and reserves were retained in both riparian areas and unclassified riparian areas (NCDs). No cattle impacts were noted in riparian areas associated with recently harvested areas.

Fish habitat

The RPPR requires that range practices avoid harming fish or fish habitat. Section 32¹⁹ of the RPPR requires that range practices be conducted so that harm to fish and fish habitat is unlikely to occur. The regulation is intended to minimize the potential for harm or damage (i.e., before it occurs) by requiring that range practices, including grazing or the construction of range developments, are done at a time and in a manner that will not likely harm or damage fish and fish habitat. No actual harm or damage to fish and fish habitat is required to be in non-compliance with the regulation.

Table 7 - Extent of fish habitat impacted by cattle

Watershed	Total length assessed (metres)	Length of fish streams assessed (metres)	Length of fish habitat impacted by cattle (metres)
Oyama	5367	2412	390
Vernon	4070	3945	432

¹⁹ S. 32 RPPR – Protection of fish

(1) A range agreement holder who carries out a range practice must ensure that the range practice is conducted at a time and in a manner that is unlikely to

- (a) harm fish,
- (b) have a material adverse effect on fish passage, or
- (c) destroy, damage or harmfully alter fish habitat.

(2) If satisfied that it is not practicable, given the circumstances or conditions applicable to a particular area, the minister may exempt a range agreement holder, in relation to that area, from subsection (1).

Riparian transects included 2412 metres of assumed²⁰ or confirmed fish streams in the Oyama Creek community watershed and 3945 metres of fish streams in the Vernon Creek community watershed (refer to Table 7). Within the transects on assumed or confirmed fish streams, auditors identified 390 metres of fish stream in the Oyama Creek watershed and 432 metres of fish stream in the Vernon Creek watershed that were impacted by cattle.

Cattle caused significant impacts to components of fish habitat by trampling stream channel banks, riparian habitat adjacent to channels, and channel beds, often resulting in impacts to spawning areas and the introduction of fine silts. Activity by cattle in riparian habitat (a vital component of fish habitat) adjacent to streams resulted in impacts to streamside vegetation and significant amounts of soil disturbance. In one instance in the Oyama Creek watershed, cattle may have caused direct harm to fish since the impacts occurred within the channel at about the same time that rainbow trout fry were observed in the section of stream.

In addition to riparian transects (Table 7), cattle impacted fish habitat at stream crossings (within the clearing width of roads). Within Oyama and Vernon Creek watersheds, cattle impacted fish habitat at four stream crossings with an estimated 50 metres of fish habitat in the Oyama Creek watershed (one crossing) and 130 metres of fish habitat in the Vernon Creek watershed (three crossings).

The audit found no evidence that agreement holders' range practices were conducted at a time and in a manner that would likely minimize harm or damage to fish and fish habitat. The RUPs make no reference to the location of fish habitat within the range tenures and there are no measures in the plans related to the timing of range practices (for example, during the sensitive life cycles of fish, such as spawning) or measures to protect fish habitat generally. Agreement holders within the watersheds may be aware of some of the streams, lakes and wetlands that support fish, but do not manage grazing to avoid these values.

Cattle activity in the watersheds has impacted fish habitat. None of the agreement holder's range practices were conducted at a time and in a manner to minimize the likelihood of this damage occurring.

Although range practices were not effective in protecting fish habitat, the lack of range use planning around fish habitat may be a key limiting factor in achieving effectiveness.



Figure 19 – example of impacted fish habitat in Vernon Creek watershed.

²⁰ Assumed fish-streams are streams that have the potential to support fish, however, a fish inventory has not been completed to confirm or deny fish presence.

FRPA and the RPPR require only a limited amount of information to be included in RUPs. Many values, including the location of fish habitat, are not required plan content unless the district manager chooses to specify the location of the value as an issue in the RUP, requiring the agreement holder to write an action to address the issue.

Information on the location of fish streams and non-fish streams is required by licensees proposing forest harvesting or road construction. Many forest licensees maintain databases and maps of fish distribution within the watersheds in which they operate and government also maintains similar information, but it is less detailed for the smaller streams often encountered by forest licensees. Mapped location of fish habitat across the range tenure may be the first step in achieving effective protection.

The audit found no evidence that the range agreement holders in the audit area conducted their activities to minimize the likelihood of harm or damage to fish and fish habitat (section 32, RPPR). This is a pervasive non-compliance and is therefore considered significant.

Table 8 - Results of the fecal sampling for the two watersheds.

Watershed		<i>Giardia</i>	<i>Cryptosporidium</i>	<i>E. coli</i> 0157:H7	<i>Campylobacter</i>
Oyama Creek	number of positive samples – unbuffered*	0	7	0	0
	number of positive samples - buffered	0	2	0	2
	total number of samples tested	24	24	37	37
Vernon Creek	number of positive samples – unbuffered**	0	4	0	1
	number of positive samples - buffered	0	1	0	0
	total number of samples tested	9	9	9	9

* Samples collected downstream of the outlet of Oyama Lake.

** Samples collected downstream of the outlet of Swalwell (Beaver) Lake.

Harmful materials

Section 33²¹ of the RPPR requires that range practices do not cause material harmful to human health to be deposited into water used for human consumption. Results of the fecal sampling for the two watersheds are in the following Table 8.

Giardia, *E. coli* 0157, *Campylobacter*, as well as certain speies of *Cryptosporidium* are considered harmful to human health. There were no samples that tested positive for *E. coli* 0157 or *Giardia*. Three samples tested positive for *Campylobacter* and 14 samples tested positive for

²¹ S. 33 RPPR – Protecting water quality

- (1) A range agreement holder who carries out a range practice must ensure that the range practice does not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks.
- (2) A range agreement holder who carries out a range practice that could have a material adverse effect on a licensed waterworks must ensure that the range practice does not
 - (a) amage the licensed waterworks, or
 - (b) alter the vegetation, soil or terrain around the licensed waterworks, if the alteration could materially increase the risk of subsequent damage to the licensed waterworks.
- (3) If satisfied that it is not practicable, given the circumstances or conditions applicable to a particular area, the minister may exempt a range agreement holder, in relation to that area, from subsection (1) or (2).

*Cryptosporidium*²². Positive samples came from both the buffered and unbuffered portions of the two watersheds.

Through literature review and consultation with experts, the audit concluded that harmful materials deposited into water in the buffered portions of the watersheds, above the lakes (see figures 9 and 10), would not likely reach the intakes in a harmful form. It is probable that the lakes retain the pathogens long enough for them to be inactivated. In contrast, harmful substances deposited in water in the unbuffered portions of the watersheds could be at risk of reaching the intakes.

Because the audit found *Campylobacter* and *Cryptosporidium* in several sampled cattle feces located in or very near watercourses that supply drinking water, the audit concluded that the requirements of section 33 of the RPPR were not met. The audit found instances in both watersheds where range practices failed to ensure that material harmful to human health was not deposited into water used for human consumption contrary to the legislation. This is a pervasive non-compliance and is therefore considered significant.

However, non-compliance with this requirement does not mean that peoples' drinking water is unhealthy, since it is unknown if the harmful material reached the intake and the water purveyor undertakes water treatment designed to eliminate pathogens before water is distributed to consumers.

Nonetheless, the audit found that to be fully effective in preventing harmful substances from being deposited into the raw drinking water supply, the cattle would need to be excluded from direct contact with watercourses in the unbuffered portions of the watersheds.

Conclusion for Criterion 5:

The audit found that range practices have not been fully effective in minimizing impacts to water quality. In particular, practices were not fully effective because:

- range developments did not adequately protect riparian, fish and water values;
- aspects of range use plans were not followed;
- riparian areas were not protected;
- fish habitat was harmed; and



Figure 20 – example of a fecal deposit sampled from a watercourse in the Vernon Creek watershed.

²² The audit did not test to determine what species of *Cryptosporidium* was found in the positive samples.

- substances harmful to human health were deposited into watercourses that supply drinking water.

Criterion 6: Range practices have not materially affected water quality at the intake

The main risk to water quality from range practices is substances harmful to human health. There is a small potential risk from sediment input, but that would likely require a substantial amount of cattle using areas immediately upstream from the intakes. The audit found that areas in the vicinity of intakes were fenced and well protected from direct cattle use.

The water purveyor (DLC) tests raw water at the intake only for total *E. coli* and fecal coliforms. Results from these tests indicate elevated levels in both watersheds in summer and comparatively low levels in winter. Sources of *E. coli* and fecal coliforms include a wide variety of animals and birds as well as cattle so the total *E. coli* and fecal coliform indicator is not a very useful one to assess the effect of range practices on water quality.

The water is not tested for *Campylobacter*, *Cryptosporidium* or *Giardia*, probably because it is quite expensive to do this on a regular basis. Consequently, the audit was not able to determine whether range practices materially affected water quality at the intakes by introducing any of these other pathogens into the source water. It is likely, however, that since *Cryptosporidium* was found in sampled fecal material downstream of the reservoirs in both watersheds, and *Campylobacter* was found below the reservoir in Vernon Creek, that range practices introduced these substances into the source water and potentially into the water supply intakes during the audit period.

Conclusion for Criterion 6:

The audit was not able to conclude whether or not range practices have materially affected water quality at the intake. It is likely, however, that range practices introduced *Cryptosporidium* and *Campylobacter* into the source water during the audit period as both of these pathogens were present in some of the fecal pats that were sampled. These organisms represent significant health risks where present in concentration in drinking water. However, it is unknown if range practices introduced these substances into the water supply intakes during the audit period. It is because the occurrence and concentrations of these two pathogens in water samples taken at the intakes are unknown that the audit is unable to conclude whether or not range practices have materially affected water quality at the intake.

Appendix A: Audit Methodology

Estimating sediment from roads, trails and landslides

The sediment estimate methodology involved detailed inspections of watercourse crossings of roads or trails, as well as roads or trails running parallel to watercourses, and other road and harvesting practices that could lead to sediment generation and transport to watercourses. Auditors estimated the amount and nature of sediment that any site would likely deliver in the upcoming year by inspecting disturbed surface areas draining towards a watercourse. In addition, auditors assessed management practices employed at each site to determine if appropriate measures had been taken to minimize sediment delivery to watercourses.

Assessing cattle effects at road crossings

Using the FREP methodology, auditors evaluated a total of 15 range indicators in 5 categories where there was evidence of cattle disturbance at the road or trail crossings of watercourses. These indicators are used to identify disturbances that have potential impacts to water quality. The five categories are:

1. Condition of the plant community—was riparian vegetation highly modified by grazing and trampling?
2. Condition of the ground surface—was there evidence of recent pugging, compaction, or unvegetated hummocks?
3. Condition of the watercourse bank and channel—was there evidence of bank erosion or cattle standing in the channel?
4. Was cattle fecal material within three metres of the watercourse or water's edge?
5. Range management practices—was there evidence of cattle drinking directly from the water source; or were fences or rip rap in place to deter cattle?

Based on these five categories, a ranking of high, moderate, or low level of impact from cattle was assigned for each site. To receive a high rating, the site had to exhibit disturbances in all five categories with at least 7 of the 15 indicators present. To receive a moderate rating, the site had to exhibit disturbances in four of the five categories with four to six of the indicators present.

Assessing cattle effects on riparian function

The audit examined riparian health in 'riparian areas' as defined by the RPPR²³ and in 'unclassified riparian areas.' In this audit, the term 'riparian area' is used when site conditions meet the definition of riparian area in the RPPR. The audit uses the term 'unclassified riparian

²³ Under the Range Planning and Practices Regulation (RPPR), the term 'riparian area' has a specific meaning.

It is an area of land that:

- (a) is adjacent to a stream, lake or wetland, and
- (b) contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas;

The regulation also gives specific meaning to a 'stream' and a 'wetland.'

areas’ to describe areas that provide riparian function but do not meet the definition of ‘riparian area’.

The following table illustrates how the riparian terms are used in this audit:

Field condition	‘Riparian area’ or ‘unclassified riparian area’
1. Riparian vegetation ²⁴ adjacent to an NCD	Unclassified riparian area
2. Riparian vegetation adjacent to a stream, lake or wetland	Riparian area
3. Riparian vegetation within a wetland (with or without an NCD flowing through the wetland)	Unclassified riparian area
4. Riparian vegetation adjacent to a stream flowing through a wetland.	Riparian area

The audit sample included a stratified random selection of watercourses (stream or NCD), wetlands and lakes, as well as areas where the DLC’s source water assessment had reported a concern about cattle impacts. Stratification of transects considered: the location in the watershed relative to the intake; location of range developments; type of watercourse, wetland or lake; and the terrain (ease of cattle access to riparian areas). An overview helicopter flight of both watersheds was completed on the first day of the audit in order for auditors to become familiar with the terrain in the watersheds, the mosaic of watercourses, wetlands and lakes, and to identify potential areas of cattle impacts to these areas that might warrant further ground assessment.

For each watercourse, wetland or lake selected for assessment, a transect was established that did not include the clearing width of a road. The length of transects varied depending on cattle access and extent of observed impacts. At each transect, auditors completed a riparian health assessment and collected additional information in the area immediately adjacent to the transect, including cattle and other causes of riparian disturbances, such as ATV use and adherence to elements of the range use plan and range practice requirements. A key element of this assessment is the direct influence of cattle on the condition of the riparian area. The methods used to assess compliance and effectiveness were developed and applied in the field by Board staff and a consulting professional agrologist.

Assessing cattle effects on fish habitat

Auditors evaluated cattle impacts to fish and fish habitat within riparian health assessment transects and at various sites such as road crossings. To do this, available inventories of fish presence and absence were used to identify watercourses that support fish and those that do

²⁴ Riparian vegetation includes species such as sedge that rely on the presence of water and are distinctly different than species found in upland areas.

not²⁵. On watercourses where this information was not available, fish presence was assumed, unless site factors made it unlikely that the watercourse would support fish. These site factors included: the absence of suitable habitat for fish; steep channel gradients (greater than 20 percent); and, the presence of permanent barriers or other obstacles to fish movement.

Assessing cattle fecal material

Samples from fecal pats were collected only if: 1) they were deposited within or up to three meters adjacent to a watercourse, wetland or lake; and, 2) the pats contained moist fecal material.

For each fecal pat sampled, auditors recorded the date of sample collection, specific location of the pat in relation to the watercourse, wetland or lake and assigned a relative index of the age of the fecal pat based on an estimation of moisture content. The fecal material was placed in a sterile container as specified by the certified laboratory retained to complete sample preparation and analysis. The laboratory also provided protocols related to cleaning equipment after each sample was collected and storage of samples prior to being submitted to the laboratory.

²⁵ Auditors used fish presence/absence mapping held by Tolko Industries Ltd. and BC Timber Sales. The mapping was funded by the Forest Investment Account and was the best information available.

Appendix B: Major Factors that Affect Drinking Water Quality

This is a partial list of major factors that can affect drinking water quality. Refer to the Guidelines for Canadian Drinking Water Quality for details on these and additional factors. The guidelines are located at the following website:

<http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php>

Microbiological Factors – this includes viruses, bacteria such as *E. coli* and *Campylobacter*, and protozoa such as *Giardia* and *Cryptosporidium*. These organisms represent significant health risks where present in concentration in drinking water. The primary goal of water treatment is to remove or kill these organisms. These organisms can adhere to sediment and organic material, reducing their sensitivity to disinfection and reducing the effectiveness of water treatment.

Metals – including copper, iron, lead, manganese, selenium, molybdenum and many others. Most metals exist in untreated and treated water at very low concentrations. Although undesirable in drinking water, at low concentrations most metals do not represent significant health risks, with lead being an exception. Since trace metals exist naturally in soil, increased sedimentation from forest practices can increase metal content in stream water, although many metals adhere to soil particles, and do not go into solution.

Chemicals – this includes a wide variety of compounds such as pesticides, fuel, fertilizers, benzenes, sulphates, nitrates, etc. The Guidelines for Canadian Drinking Water Quality include maximum acceptable concentrations for more than 60 chemical compounds. The risk of introducing chemicals into stream systems through forest practices is relatively low. However, examples of potential risks include fuel spills from poor machinery refuelling practices or accidents, and fertilization and herbicide treatments of forest crops.

Turbidity – is a measure of light transmission through water. Turbidity is affected by sediment such as clay and silt particles as well as dissolved and fine particulate organic materials. While turbid water in itself does not represent a health risk, it reduces the efficacy of some water treatments and is an indirect measure of sediment which can also reduce water treatment effectiveness. Turbidity is the most common factor influenced by forest practices, through the introduction of sediment and organic matter into streams.

Aesthetic Factors – such as colour, taste, smell, temperature. These aesthetic factors are generally not a health risk. The Guidelines for Canadian Drinking Water Quality set aesthetic objectives for these parameters. In a forestry context, poor riparian management practices on small streams can contribute to increased stream temperatures when shade vegetation is removed from streambanks. Organic materials introduced into the water can also contribute to poor water colour, taste and smell.

Appendix C: Audit Report Response from Coldstream Ranch



COLDSTREAM RANCH (2002) LTD.

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June 29, 2012

Forest Practices Board
PO Box 99025
Stn Prov Gov't
Victoria, BC V8W 9R1

Attention: **Al Gorley, Chair and Chris Mosher, Director, Audits**

Re: Formal Response to Forest Practices Board's Water Quality Audit Report

Dear Sirs,

Please consider the following as the formal response from Coldstream Ranch (2002) Ltd. (herein "Coldstream Ranch") with regards to the Forest Practices Board's (herein the "Board") Water Quality Audit report, as presented to Coldstream Ranch on June 7th, 2012.

Qualifications of Auditors

There is no question regarding the professionalism of the individual auditors; however, there is a significant concern regarding the qualifications of each auditor, and the team as a whole, with respect to range practices and management. It appeared that the auditors had limited expertise and experience with the ranching industry, based on information provided during the audit and biographies posted on the Board's website. As a result each auditor's ability to make comments and/or recommendations with regards to practice standards would subsequently be limited and may not accurately reflect standard, acceptable range practices. In addition, since all auditors seem to have a diverse background in either the forestry sector and/or the environmental sector, their approach would be based on that experience. For example, a Register Professional Biologist (RPBio) who has an extensive background as a habitat biologist working within the forest and mining industries, but no range experience, would focus on how forestry/mining operations approached fish and fish habitat. That RPBio may not be able to bridge the gap between those sectors and applications within a range management setting.

In addition, there was no Professional Agrologist (PAg) with the appropriate experience among the audit team to provide technical or expert advice upon legal and "standard" range practices. Without proper experience, first-hand knowledge, and a qualified range professional, the auditors would be unable to make an accurate assessment and ruling on practice standards.

"Established in 1863"

Finally, the *Forest and Range Practices Act* (FRPA) training material, such as the FRPA Range Training Guide from 2004, recommends that plans are developed by qualified professionals, such as a PAg. If a qualified professional is required to develop and implement an effective Range Use Plan (RUP) or Range Stewardship Plan (RSP), it is reasonable to conclude that the individual(s) auditing RUPs and/or RSPs also have the necessary qualifications to be considered a Qualified Professional in terms of range management.

Coldstream Ranch recommends that future audits consider the importance of professional qualifications and ensure at least one member of the audit team has the appropriate qualifications in range practices and management. In addition, the Board should develop a standard audit protocol with regards to range audits, including procedures for the random selection of sites and transects to reduce auditor-induced bias. This will help reduce uncertainty and provide a clearer understanding for auditees as to what is being measured.

Agreement Holders' Access to Information

Report states the "*agreement holders did not utilize available information about the distribution of fish...*" (Page 3: 2nd paragraph of Commentary). This is a misleading, not to mention contradictory to other statements within the report, as this information is NOT readily available to the ranchers. Stream classifications are completed by Timber Licensees and are only sometimes shared with Range Tenure Holder (i.e. on referral maps). If the riparian feature is classified after the referral, which is often the case with TRIM information and unmapped riparian features, the range agreement holder would not see classification information until the next round of referrals.

Further, even if range agreement holders had access to the information, such as through Fish Wizard, queries require a watershed code, TRIM Mapsheet or gazetted name. Although it may be reasonable to query major streams, the majority of streams in a watershed (even fish streams) do not have a gazetted name associated with them, which makes it virtually impossible for identification. For example, a query based on watershed code "310-939400" returns 316 records. Approximately 61 have a gazette name associated with the feature, whether it is a creek or lake). The remaining 255 records have no name and are simply identified by a number.

External Contributing Factors

The audit findings and report failed to recognize external contributing factors that contribute, and sometimes create, range use impacts. One example is the fact that timber-range referrals from Timber Licensees and Small Scale Salvage Operators often lack pertinent information necessary for the range holder to adequately respond in regards to potential conflicts. A Timber Licensee will refer proposed roads and blocks, but generally does not show riparian features unless pre-existing within TRIM data (which is not always accurate) and no riparian classification unless previously assessed. Without riparian locations and classifications, range agreement holders are often unaware that the feature exists until post-harvest and then it is too late as access is already created. Based on the information contained within the audit

report, it does not appear that auditors gave consideration to external factors, such as referral information. As illustrated by the example above, access can be created without the range agreement holder's knowledge, yet the Board (and FRPA) holds the range agreement holder solely responsible for mitigating impacts and non-compliances.

With regards to the subsequent offer for the Board being open to discussing issues outside the scope of this audit in the future, Coldstream Ranch would welcome such a discussion.

Fish Habitat

The range agreement holders are opposed to reference of fish habitat management requirements, since the District Manager exempted them from managing for it. It is believed this was not acknowledged by the auditors or the Board.

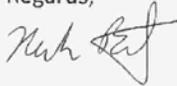
The report should only discuss information that is known and can be proven. The second paragraph of page 17 refers to "assumed" fish stream. If the streams could not be confirmed as fish-bearing, using the assumption that they are fish-bearing creates a bias and potentially erroneous results. The audit findings, with regards to fish habitat, should be limited to known fish-bearing streams.

The section "*Assessing cattle effects on fish habitat*", on page 18, illustrates sampling biases of this audit. Information collected from random transects (i.e. selected randomly without field knowledge) would most likely provide the most accurate overview of the conditions within the audit area. However, the last paragraph of this section indicates fish habitat quality assessments were conducted where habitat appears impacted by cattle or other land uses. Areas selected from aerial flights and road crossings (i.e. ease of access), would result in skewed summaries that would show greater damage than actually exists.

Effectiveness of Range Developments

In addition, the third bullet on page 35, fails to recognize that despite noted "concentrated use and impacts...at the fence line locations", overall the riparian use has been reduced. This would result in improved vegetation growth and better filtration. The goal of the *Range Planning and Practices Regulation* (RPPR) is to mitigate impacts, not completely eliminate them. It is also noted that there is no reference to the percent of soil disturbance and/or mineral soil exposure, both of which are used to determine concentrated trampling by the Riparian Management Area (RMA) Guidebook.

Regards,



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